2004-03-143

Aquila, Incorporated

20 West 9th Street, Kansas City, Missouri 64105

South Harper Peaking Facility

24110 S. Harper Road, Peculiar, Missouri 64708

Cass County, S29/32, T45N, R32W

Installation of three natural gas fired simple cycle combustion turbines, a 9.8 million Btu per hour natural gas fired heater, and a 0.47 million Btu per hour emergency diesel fire pump to generate a total nominal electrical power output of 341 megawatts during peak electricity demand periods. This review was conducted in accordance with Section (8), Missouri State Rule 10 CSR 10-6.060, *Construction Permits Required*.

SPECIAL CONDITIONS:

The permittee is authorized to construct and operate subject to the following special conditions:

The special conditions listed in this permit were included based on the authority granted the Missouri Air Pollution Control Program by the Missouri Air Conservation Law (specifically 643.075) and by the Missouri Rules listed in Title 10, Division 10 of the Code of State Regulations (specifically 10 CSR 10-6.060). For specific details regarding conditions, see 10 CSR 10-6.060 paragraph (12)(A)10. "Conditions required by permitting authority."

South Harper Peaking Facility
Cass County, S29/32, T45N, R32W

1. Operational Limitation
   A. South Harper Peaking Facility (Aquila) shall burn only natural gas from the three natural gas fired simple cycle combustion turbines. If Aquila wishes to use any other type of fuel in the future in any of the three turbines, the Best Available Control Technology (BACT) analysis and ambient air quality analysis will need to be re-evaluated.

   B. Except during periods of startup and shutdown, Aquila shall limit the total hours of operation of the three Siemens-Westinghouse Model 501D5A turbines (Emissions Points EP-01, EP-02, and EP-03) to less than 5,000 hours in any consecutive 12-month period.

   C. Except during periods of startup and shutdown, Aquila shall limit the total hours of operation of each of the three Siemens-Westinghouse Model 501D5A turbines (EP-01, EP-02, and EP-03) to less than 2,000 hours in any consecutive 12-month period, except in the case of a Force Majeure Event. In the case of a Force Majeure Event that renders one or two gas turbines inoperable, the total unused permitted hours of operation may be transferred to the remaining operable unit(s). In order for an event to be considered a Force Majeure Event, Aquila must receive approval from the Air Pollution Control Program's Enforcement Section.

   D. Except during periods of startup and shutdown, Aquila shall limit the total hours of operation of the gas heater (EP-04) to less than 6,000 hours in any consecutive 12-month period.

   E. Except during periods of startup and shutdown, Aquila shall run the three Siemens-Westinghouse Model 501D5A turbines (EP-01, EP-02, and EP-03) at a load level no less then 75 percent.

2. Emission Limitation
   A. Except during periods of startup and shutdown, Aquila shall limit Nitrogen Oxide (NO_X) emissions from each of the Siemens-Westinghouse Model

SPECIAL CONDITIONS:

The permittee is authorized to construct and operate subject to the following special conditions:

501D5A turbines (EP-01, EP-02, and EP-03) to 15 parts per million by volume (ppmvd) corrected to 15 percent (%) oxygen on a dry basis for a three-hour rolling average.

B. Except during periods of startup and shutdown, Aquila shall limit NO_x emissions from each turbine to less than 81.5 pounds per hour when operating at 100% load, 69.9 pounds per hour when operating at 85% load and 62.0 pounds per hour when operating at 75% load.

C. Except during periods of startup and shutdown, Aquila shall limit Carbon Monoxide (CO) emissions from each of the Siemens-Westinghouse Model 501D5A turbines (EP-01, EP-02, and EP-03) to 25 ppmvd corrected to 15 percent (%) oxygen on a dry basis for a three hour rolling average.

D. Except during periods of startup and shutdown, Aquila shall limit CO emissions from each turbine to less than 82.7 pounds per hour when operating at 100% load, 71.0 pounds per hour when operating at 85% load and 63.0 pounds per hour when operating at 75% load.

E. Except during periods of startup and shutdown, Aquila shall limit emissions of Particulate Matter less than ten microns in aerodynamic diameter (PM_{10}) to less than 15.25 pounds per hour when utilizing wastewater injection for Turbine Number One (Siemens-Westinghouse Model 501D5A, EP-01) and 10.00 pounds per hour from Turbine Numbers Two and Three (Siemens-Westinghouse Model 501D5A, EP-02 and EP-03) and Turbine One when not using wastewater injection.

3. Compliance Testing

Stack tests shall be performed on one of the three identical gas turbines permitted herein at Aquila sufficient to demonstrate compliance with the Special Conditions contained in this permit. Specifically, the stack testing shall:

A. Demonstrate compliance with the emission limitations specified in Special Conditions 2.A through 2.E.

B. Develop a formaldehyde emission factor in order to verify compliance with the modeling analysis. In the event that lean pre-mix combustion turbines are de-listed from the National Emission Standards for Hazardous Air Pollutants (NESHAP) regulations, as proposed by the Environmental Protection Agency (EPA) on April 7, 2004, Aquila may substitute AP-42 formaldehyde emission factors to demonstrate compliance with emission conditions and eliminate the testing requirement of Special Condition 3B.

SPECIAL CONDITIONS:

The permittee is authorized to construct and operate subject to the following special conditions:

C. Demonstrate compliance with Subpart GG, *Standards of Performance for Stationary Gas Turbines,* of the New Source Performance Standards (NSPS).

D. Be conducted across the full range of loads (i.e. 75%, 85%, and 100%) that the turbines are expected to operate.

E. The emission tests required by this permit for the turbines shall be conducted in accordance with the following methods and procedures:

1) The test methods and procedures outlined in 40 CFR §60.335, *Tests Methods and Procedures,* shall be adhered to by the applicant in testing for NO_X from the combustion turbines. Environmental Protection Agency (EPA) Method 20, or another method approved by the Director, shall be used to determine the NO_X emission rate.

2) The test methods and procedures outlined in 40 CFR Part 60, Appendix A, Method 10, or another method approved by the Director, shall be adhered to by the applicant in testing for CO.

3) The test methods and procedures outlined in EPA Method 5 and 202, or another method approved by the Director, shall be adhered to by the applicant in testing for PM_{10}.

4) The test methods and procedures outline it 40 CFR Part 60, Appendix A, Method 18, or another method approved by the Director, shall be adhered to by the applicant in testing for formaldehyde.

F. The stack test shall be performed within 60 days of achieving the maximum production rate of the turbines but no later than 180 days after initial startup for commercial operation of the turbines and shall be conducted in accordance with the stack procedure outlined in Special Conditions 3.A through 3.J. The test shall be conducted every five (5) years from the date of the initial test.

G. The date on which performance tests are conducted must be pre-arranged with the Air Pollution Control Program a minimum of 30 days prior to the proposed test so that a pretest meeting may be arranged if necessary, and to assure that the test date is acceptable for an observer to be present. A completed Proposed Test Plan form (copy enclosed) may serve the purpose of notification and must be approved by the Air

SPECIAL CONDITIONS:

The permittee is authorized to construct and operate subject to the following special conditions:

Pollution Control Program prior to conducting the required emission testing.

H. Two copies of a written report of the performance test results shall be submitted to the Director of the Air Pollution Control Program within 30 days of completion of any required testing. The report must include legible copies of the raw data sheets, analytical instrument laboratory data, and complete sample calculations from the required EPA method for at least one sample run.

I. The test report is to fully account for all operational and emission parameters addressed by these permit conditions as well as in Subpart GG of the NSPS.

J. Pursuant to 40 CFR §60.8(b)(3) and subject to the following conditions, Aquila may substitute the 40 CFR Part 75 NO_X and diluent continuous emission monitoring system (CEMS) certification procedures for the Reference Method 20 testing for the purpose of demonstrating initial compliance with Subpart GG of the NSPS. If the Part 75 NO_X and diluent CEMS certification procedures are chosen to demonstrate initial compliance, Aquila shall adhere to the following requirements:

1) Aquila shall successfully complete the Part 75 NO_X and diluent CEMS certification tests so that the data are, at a minimum, conditionally certified prior to the testing deadlines outlined in 40 CFR §60.8(a) or Part 75, whichever date is earlier.

2) Aquila shall perform a stratification test for NO_X and diluent pursuant to the procedures specified in 40 CFR Part 75, Appendix A, Section 6.5.6.1(a) through (e) or Section 6.5.6.2 (a) through (e). Once the stratification sampling is completed, Aquila shall analyze the data using the procedures in Section 6.5.6.3(a) and (c) to determine if subsequent RATA testing will occur along a short or long reference method measurement line. The short or long reference method measurement line, as determined above, will serve in lieu of the sampling points usually required by Reference Method 20. In no case shall RATA be based on fewer than three sample points as specified in 40 CFR Part 60, Appendix B, Performance Specification 2, Section 3.2.

3) Since the PSD permit limits Aquila to only natural gas, the SO_2 measurement requirements under 40 CFR Part 60, Appendix A, Reference Method 20, Section 6.3 are waived pursuant to 40 CFR

SPECIAL CONDITIONS:

The permittee is authorized to construct and operate subject to the following special conditions:

§60.8(b)(4).

4. Continuous Emission Monitoring System (CEMS)

A. Aquila shall install, calibrate, maintain, and operate CEMS, and record the output of the systems, for measuring NO_X emissions discharged into the atmosphere. These systems shall be placed in an appropriate location on each combustion turbine's flue gas exhaust such that accurate readings are possible.

B. Aquila shall install, calibrate, maintain, and operate a CEMS, and record the output of the systems, for measuring the oxygen (O_2) content of the flue gases at each location where NO_X emissions are monitored. The O_2 content of the flue gases may be determined by use of either an O_2 CEMS or a CO_2 CEMS. If Aquila elects to use a CO_2 CEMS, the conversion process in EPA Method 20 must be used to correct the NO_X concentrations to 15 percent O_2.

C. The CEMS required by Special Condition Number 4.A shall be installed and operated according to the guidelines in 40 CFR Part 75 for the NO_X and diluent CEMS requirements.

D. The CEMS required by Special Condition Number 4.A shall be installed and operated according to the guidelines in 40 CFR §60.13, *Monitoring requirements*; in 40 CFR Appendix B, Performance Specification 3 – *Specifications and test procedures of O_2 and CO_2 Continuous Emission Monitoring Systems in Stationary Sources*; and in 40 CFR Appendix F, *Quality Assurance Procedures*.

5. Record Keeping

A. Aquila shall keep monthly, and the sum of the most recent 12-months, records that are adequate to determine compliance with Special Condition Number 1.B (total installation hours of operation). Attachment A, *Operational Schedule of the Three Siemens-Westinghouse Model 501D5A Turbines,* or an equivalent form of the company's own design, is suitable for this purpose. The most recent 60 months of records shall be maintained on-site and shall be made immediately available to Missouri Department of Natural Resources' personnel upon request.

B. Aquila shall keep monthly, and the sum of the most recent 12-months, records that are adequate to determine compliance with Special Condition Number 1.C (individual turbine hours of operation). Attachment B, *Individual Turbine Operational Schedule*, or an equivalent form of the

SPECIAL CONDITIONS:

The permittee is authorized to construct and operate subject to the following special conditions:

company's own design, is suitable for this purpose. The most recent 60 months of records shall be maintained on-site and shall be made immediately available to Missouri Department of Natural Resources' personnel upon request.

C. Aquila shall keep monthly, and the sum of the most recent 12-months, records that are adequate to determine compliance with Special Condition Number 1.D (gas heater hours of operation). Attachment C, *Gas Heater Operational Schedule*, or an equivalent form of the company's own design, is suitable for this purpose. The most recent 60 months of records shall be maintained on-site and shall be made immediately available to Missouri Department of Natural Resources' personnel upon request.

6. Reporting

A. Aquila shall report to the Air Pollution Control Program's Enforcement Section, P.O. Box 176, Jefferson City, Missouri 65102, no later than ten (10) days after the end of each month if the 12-month cumulative total (Special Condition 5.A) records show that the source exceeded the limitation of Special Condition 1.B (5,000 hours of operation).

B. Aquila shall report to the Air Pollution Control Program's Enforcement Section, P.O. Box 176, Jefferson City, Missouri 65102, no later than ten (10) days after the end of each month if the 12-month cumulative total (Special Condition 5.B) records show that the source exceeded the limitation of Special Condition 1.C (2,000 hours of operation per turbine).

C. Aquila shall report to the Air Pollution Control Program's Enforcement Section, P.O. Box 176, Jefferson City, Missouri 65102, no later than ten (10) days after the end of each month if the 12-month cumulative total (Special Condition 5.C) records show that the source exceeded the limitation of Special Condition 1.D (6,000 hours of operation).

D. Pursuant to 40 CFR §60.13(i), Aquila may make use of 40 CFR Part 75, Appendix D as an alternative to the fuel monitoring and sulfur fuel sampling and analysis requirements of Subpart GG of the NSPS. If Aquila elects to use this alternative, Aquila is subject to the following requirements:

1) Aquila shall submit an excess emissions report to the Air Pollution Control Program's Enforcement Section consistent with the format and schedule described in 40 CFR §60.7(d); and

2) For the purpose of excess emission reporting, Aquila shall report

SPECIAL CONDITIONS:

The permittee is authorized to construct and operate subject to the following special conditions:

each day during which the sulfur content of the fuel exceeds the 0.8 percent by weight limitation.

E. Aquila shall report to the Air Pollution Control Program's Enforcement Section, P.O. Box 176, Jefferson City, Missouri 65102, no later than ten (10) days after the end of the month, in which performance testing has been performed and indicates non-compliance with Special Condition 2.A, 2,B, or 2.C.

F. In the case of a Force Majeure Event, Aquila shall notify the Air Pollution Control Program's Enforcement Section, P.O. Box 176, Jefferson City, Missouri 65102, no later than ten (10) days after an event has occurred that Aquila feels meets the definition of a Force Majeure Event.

Note 1: The term "startup and shutdown" used herein is hereby defined as those periods of time that a gas turbine is operated at a load level less than 75%.

Note 2: The term "Force Majeure Event" used herein is hereby defined as any event, occurrence, or circumstance beyond the reasonable control of, and without the fault or negligence of, Aquila. "Force Majeure Event " shall include, but are not limited to, earthquakes, fires, floods, lightning strikes, acts of the public enemy, war, or regulations or restrictions imposed by governmental, military, or lawfully established civilian authorities. The Air Pollution Control Program's Enforcement Section must approve a circumstance before it may be considered a Force Majeure Event.

REVIEW OF APPLICATION FOR AUTHORITY TO CONSTRUCT AND OPERATE
SECTION (8) REVIEW
Project Number: 2004-03-143
Installation ID Number: 037-0063
Permit Number:

South Harper Peaking Facility
24110 S. Harper Road
Peculiar, Missouri 64708

Complete: March 29, 2004
Reviewed: April 7, 2004

Parent Company:
Aquila, Incorporated
20 West 9th Street
Kansas City, Missouri 64105

Cass County, S29/32, T45N, R32W

REVIEW SUMMARY

- South Harper Peaking Facility (Aquila) has applied for the authority to install three natural gas fired simple cycle combustion turbines to generate a total nominal electrical power output of 341 megawatts (MW) during peak electricity demand periods. The three gas turbines to be utilized are identical Siemens Westinghouse Model 501D5A units. The individual turbine units have a maximum hourly design rate (MHDR) heat input of 1,455 million British Thermal Units (MMBtu) per hour. The project will also consist of a 9.8 MMBtu per hour natural gas fired heater, used to pre-heat the natural gas fuel supplied to the turbines and a 0.47 MMBtu per hour emergency diesel fire pump.

- Hazardous Air Pollutant (HAP) emissions are expected from the heater and three turbines due to the combustion of natural gas and the fire pump due to the combustion of diesel fuel. The primary HAPs of concern from the proposed equipment are acrolein, formaldehyde, and polycyclic aromatic hydrocarbons (PAH). The potential emissions of formaldehyde (CAS Number 50-00-0) are above its respective threshold level, but less than major source levels.

- 40 CFR Part 60 Subpart GG, *Standards of Performance for Stationary Gas Turbines* is applicable to the three gas turbines permitted herein.

- None of the National Emission Standards for Hazardous Air Pollutants (NESHAP) in 40 CFR Part 61 are applicable to this project.

- Maximum Achievable Control Technology (MACT), Subpart YYYY, *Combustion Turbines* does not apply because potential emissions of formaldehyde are limited to de minimis.

- 10 CSR 10-6.060(9), *Hazardous Air Pollutant Permits*, is not applicable to this project since the conditions of this permit limit the formaldehyde emissions to a de

minimis level and require emission testing as verification.

- This review was conducted in accordance with Section (8) of Missouri State Rule 10 CSR 10-6.060, *Construction Permit Required*. Potential emissions of NO_X and CO are above major thresholds. Potential emissions of PM_{10} are above significant levels (i.e. de minimis levels). Potential emissions of all other pollutants are at de minimis levels.

- Since potential emissions of total and individual HAPs are at de minimis levels, this installation is not considered a major source of HAPs as defined in 40 CFR Part 63, and 10 CSR 10-6.060(9).

- The Best Available Control Technology (BACT) requirements apply to the proposed equipment. The BACT analysis was based upon each turbine operating in simple cycle mode, burning exclusively natural gas, and operating only 2,000 hours per year. NO_X emissions from the gas turbines will be controlled through the use of dry low-NO_X burners. Good combustion practices will be utilized to control CO emissions. The exclusive use of low ash/low sulfur containing fuel, together with good combustion practices, will be utilized in controlling PM_{10} and SO_X emissions. A re-evaluation of the BACT analysis and/or ambient air quality analysis will be required if South Harper Peaking Facility wishes to: retrofit the turbines with a heat recovery steam generator within a short period of time (e.g. 4-5 years) that would otherwise be accommodated within a phased Prevention of Significant Deterioration (PSD) permit, burn other forms of fuel in any of the three turbines, or wishes to increase the hours of operation limitation for each turbine.

- This installation is on the List of Named Installations [10 CSR 10-6.020(3)(B), Table 2] Number 27. A stationary source category which, as of August 7, 1980, is being regulated under Section 111 or 112 of the Act. This installation is subject to Subpart GG of the NSPS, which applies to gas turbines installed after October 3, 1977. Therefore, the major source threshold for all criteria pollutants is 100 tons per year.

- This installation is located in Cass County, an attainment area for all criteria air pollutants.

- Air quality modeling for this project was performed to determine the ambient impact of those pollutants that will be emitted in significant amounts (NO_X, CO, and PM_{10}). Air quality modeling was also performed to determine the ambient impact of formaldehyde. Based upon the model reviewed by the Air Pollution Control Program staff, the study submitted by Aquila is complete and demonstrates there will not be an exceedance of the National Ambient Air Quality Standards (NAAQS), Risk Assessment Levels (RALs), or available increment.

- Ambient air monitoring was not required for this project since the modeling analysis indicated that the ambient impacts of the modeled pollutants were below significance thresholds. Continuous Emission Monitoring Systems (CEMS) are required on each combustion turbine to demonstrate compliance with NO_X emissions limits.

- Emission testing for NO_X, CO, PM_{10}, and formaldehyde will be required as specified in the special conditions of this permit.

- A Part 70 Operating Permit application is required for this installation within 1 year of equipment startup.

- Approval of this permit is recommended with special conditions.

INSTALLATION/PROJECT DESCRIPTION

South Harper Peaking Facility (Aquila) has applied for the authority to construct three natural gas fired simple cycle combustion turbines to generate a total nominal electrical power output of 341 MW during peak electricity demand periods in Cass County near Peculiar, Missouri. The plant was to be located originally near Harrisonville, Missouri and public notice for the initial location took place earlier this year. On September 13, 2004, a revised PSD permit application was received changing the location of the plant to Peculiar, Missouri.

The three gas turbines to be utilized for this project are identical Siemens-Westinghouse Model 501D5A units that will be fired exclusively with natural gas. The individual turbine units have a heat input of 1,455 MMBtu per hour. This heat input is taken at a worst case ambient temperature of negative 1.8 degrees Fahrenheit (˚F), an ambient relative humidity of 60%, a barometric pressure of 14.458 pounds per square inch absolute, and is based on a higher heating value of natural gas. Each 4-stage Siemens-Westinghouse Model 501D5A gas turbine utilizes 14 can-type dry low-NO_X combustors in a circular array. It incorporates a 19-stage axial flow compressor, and utilizes electric starting motors. Each turbine will power an air-cooled, 60 hertz (i.e. 3600 revolutions per minute) generator. The project will also consist of a 9.8 MMBtu per hour natural gas fired heater used to heat the natural gas fuel supplied to the turbines and a 0.47 MMBtu per hour emergency diesel fire pump.

Simple cycle turbines have high volume, high temperature exhaust streams. The maximum heat input and subsequent generating capacity of each turbine depends on ambient conditions. At higher temperatures, the heat consumption and output generally decreases. Potential emissions from the turbines are greatest during periods of low ambient temperature since more fuel can be burned during these times. However, the turbine is operating at its maximum efficiency during lower temperatures. The Siemens-Westinghouse Model 501D5A turbines are equipped with dry low-NO_X burners, which will achieve a maximum NO_X emission rate of 15 parts per million by volume on a dry basis (ppmvd) when corrected to 15% oxygen in the stack gas.

In order to distinguish between a peaking station and a baseload station, the Air Pollution Control Program has previously limited the hours of operation of power plants that are strictly designed as peaking stations. The limitation on hours of operation ensures an installation, that is permitted as a peaking station, does not operate continuously as a baseload station. The annual hours of operations that a power plant will operate impacts the conclusions arrived at in a project's Best Available Control Technology (BACT) analysis. Recent permits issued by the Air Pollution Control

Program have limited each turbine to 2,000 hours per year with a limitation of 5,000 hours per year for all the turbines combined. The same limitation applies to the Aquila installation.

EMISSIONS/CONTROLS EVALUATION

All of the criteria pollutants will be emitted from the operation of these units, with PM_{10}, NO_X, and CO being emitted in amounts greater than significance levels (i.e. greater than de minimis levels). HAP emissions are also expected due to the operation of the turbines, with the main HAP of concern being formaldehyde. Potential emissions of both formaldehyde and VOCs are at their respective de minimis levels. The emission factor used to determine formaldehyde emissions will be verified through stack testing. Dry low-NO_X burners will be used to control NO_X emissions from the turbines. The Special Conditions of this permit limits the NO_X emissions to 15 ppmvd on a three-hour rolling average. Good combustion practices will be used to control CO emissions from the turbines. The CO emissions of the turbines are limited to 25 ppmvd on a three-hour rolling average by the Special Conditions of this permit.

The emission factors used to estimate emissions from the Siemens-Westinghouse Model 501D5A turbines for the criteria pollutants were provided by the equipment manufacturer.

Potential emissions of the application represent the potential of the proposed equipment, assuming continuous operation (8760 hours per year). Conditioned potential emissions are based on an annual limit of 2,000 hours for each the three turbines and 6,000 hours for the gas heater. The potential emissions in Table 1 represent the emission rate at 100% loading and ambient conditions of 0.0˚F. Emissions from start-up and shutdown are not included in the emission estimates in the table.

Table 1: Emissions Summary (tons per year)

Pollutant	Regulatory *De Minimis* Levels	Existing Potential Emissions	Existing Actual Emissions	Potential Emissions of the Application	Conditioned Potential Based on Hours Limitation	New Installation Conditioned Potential
PM_{10}	15.0	N/A	N/A	154.72	35.47	N/A
SO_x	40.0	N/A	N/A	12.00	2.86	N/A
NO_x	40.0	N/A	N/A	1,075.16	247.42	N/A
VOC	40.0	N/A	N/A	75.13	17.26	N/A
CO	100.0	N/A	N/A	1,090.22	250.53	N/A
Acrolein	0.04*/10.0	N/A	N/A	0.12	0.03	N/A
Formaldehyde	2.0*10.0	N/A	N/A	13.58	3.10	N/A
PAH	0.01*/10.0	N/A	N/A	0.04	0.01	N/A
Total HAPs	10.0/25.0	N/A	N/A	19.72	4.54	N/A

N/A = Not Applicable

* Threshold level for the HAP of concern.

PERMIT RULE APPLICABILITY

This review was conducted in accordance with Section (8) of Missouri State Rule 10 CSR 10-6.060, *Construction Permits Required*. Potential emissions of NO_X and CO are above major thresholds. Potential emissions of PM_{10} are above significant levels (i.e. de minimis levels). Potential emissions of all other pollutants are at de minimis levels.

APPLICABLE REQUIREMENTS

South Harper Peaking Facility shall comply with the following applicable requirements. The Missouri Air Conservation Laws and Regulations should be consulted for specific record keeping, monitoring, and reporting requirements. Compliance with these emission standards, based on information submitted in the application, has been verified at the time this application was approved. For a complete list of applicable requirements for your installation, please consult your operating permit application.

GENERAL REQUIREMENTS

- *Submission of Emission Data, Emission Fees and Process Information*, 10 CSR 10-6.110

  The emission fee is the amount established by the Missouri Air Conservation Commission annually under Missouri Air Law 643.079(1). Submission of an Emissions Inventory Questionnaire (EIQ) is required April 1 for the previous year's emissions.

- *Operating Permits*, 10 CSR 10-6.065

- *Restriction of Particulate Matter to the Ambient Air Beyond the Premises of Origin*, 10 CSR 10-6.170

- *Restriction of Emission of Visible Air Contaminants*, 10 CSR 10-6.220

- *Restriction of Emission of Odors*, 10 CSR 10-2.070

SPECIFIC REQUIREMENTS

- *Maximum Allowable Emissions of Particulate Matter From Fuel Burning Equipment Used for Indirect Heating*, 10 CSR 10-2.040

- *New Source Performance Regulations*, 10 CSR 10-6.070 – *New Source Performance Standards (NSPS) for Stationary Gas Turbines*, 40 CFR Part 60, Subpart GG.

- *Restriction of Emission of Visible Air Contaminants,* 10-CSR 10-6.220

- *Restriction of Emission of Sulfur Compounds,* 10 CSR 10-6.260
- *Acid Rain Source Permits Required,* 10 CSR 10-6.270
- *Emission Limitations and Emissions Trading of Oxides of Nitrogen*, 10 CSR 10-6.350
- *Restriction of Emission of Particulate Matter From Industrial Processes*, 10 CSR 10-6.400

BACT ANALYSIS

Introduction

Any source subject to Missouri State Rule 10 CSR 10-6.060, *Construction Permits Required*, Section (8) must conduct a Best Available Control Technology (BACT) analysis on any pollutant emitted in greater than de minimis levels. The BACT requirement is detailed in Section 165(a)(4) of the Clean Air Act, at 40 CFR 52.21 and 10 CSR 10-0.60(8)(B).

A BACT analysis is done on a case by case basis and is performed using a "top-down" method. The following steps detail the top-down approach:

1. Identify all potential control technologies – must be a comprehensive list, it may include technology employed outside the United States and must include the Lowest Achievable Emission Rate (LAER) determinations.
2. Eliminate technically infeasible options – must be well documented and must preclude the successful use of the control option.
3. Rank remaining control technologies – based on control effectiveness, expected emission rate, expected emission reduction, energy impacts, environmental impacts, and economic impacts.
4. Evaluate the most effective controls – based on case by case consideration of energy, environmental, and economic impacts.
5. Select BACT.

The three turbines being permitted by Aquila are subject to Section (8) and have conditioned potential of PM_{10}, NO_X, and CO emissions above significance levels (i.e. greater than de minimis). Aquila prepared a BACT analysis for PM_{10}, NO_X, and CO based on the U.S. EPA RACT/BACT/LAER Clearinghouse (RBLC) database, vendor information, and previous permits for combustion turbines issued in the State of Missouri and elsewhere. The BACT determination must be at least as stringent as the NSPS for Combustion Turbines set forth in 40 CFR 60. The applicant has proposed emissions well below the NSPS limits. The BACT analysis is summarized, by pollutant, below.

NO_X Control Technologies

The conditioned potential emissions of NO_X resulting from the project permitted herein are significant (i.e. greater than 40.0 tons per year). Therefore, a BACT analysis is required for this pollutant. Table 2 lists the control technologies Aquila evaluated for this

review (in order of control achieved) and the emission rates each control technology can attain.

Table 2: NO_X Control Technologies Considered

Control Technology	Emission Rate Achieved
SCONOX™	2 ppmvd
XONON ™	3 ppmvd
Selective Catalytic Reduction (SCR)	3-9 ppmvd
Selective Non-catalytic Reduction (SNCR)	4-10 ppmvd
Dry Low-NO_X Burner	9-25 ppmvd
Water/Steam Injection	22-42 ppmvd

SCONOX™

The SCONOX™ system is an add-on control device that uses an oxidation/absorption/regeneration cycle across a catalyst bed to achieve back-end reductions of NO_X, CO, and VOC. The system does not require ammonia as a reagent, and involves parallel catalyst beds that are alternately taken off line through means of mechanical dampers for regeneration.

According to Goal Line Technologies, LLC, the SCONOX™ catalyst works by simultaneously oxidizing CO to CO_2, NO to NO_2, and then absorbing NO_2. The NO_2 is absorbed into a potassium carbonate catalyst coating as potassium nitrite (KNO_2) and potassium nitrate (KNO_3). When a catalyst module begins to become loaded with KNO_2 and KNO_2, it is taken off line and isolated from the flue gas stream with mechanical dampers for regeneration. Once the module has been isolated from the turbine exhaust [contains approximately five percent (5%) oxygen], four percent (4%) hydrogen in an inert carrier gas of nitrogen or steam is introduced. An absence of oxygen is necessary to retain the reducing properties necessary for regeneration. The lower flammability limit for hydrogen is 4%, so it is important that the air seals around the dampers do not leak. Hydrogen reacts with potassium nitrites and nitrates during regeneration to form water (H_2O) and nitrogen (N_2), which is emitted from the stack.

The SCONOX™ system can operate effectively at temperatures ranging from 300˚F to 700˚F. The gas turbines permitted herein will have an exhaust gas temperature of 950˚F to 984˚F. The exhaust gas from these turbines would have to be lowered to accommodate this air pollution control system. The SCONOX™ system manufacturer indicates that this technology can be applied to simple cycle turbines. Therefore, this control technology is considered technically feasible for this project.

SCONOX™ is a new technology and has been demonstrated on a 23 MW combined cycle turbine in the State of California. However, it has yet to be demonstrated for long term commercial operation on simple cycle turbines operated as peak power generation units. It is an inherent necessity for peak power generation units to be capable of rapid start-up and shutdown. The unknowns associated with any pollution control system which is the first of its kind, and which has no long term company or operation history, represents a level of risk that would alter the ability to reasonably finance the project. Therefore, SCONOX™ was eliminated as BACT for NO_X for this project.

XONON™

The XONON™ technology replaces traditional flame combustion with flameless catalytic combustion. The XONON™ system utilizes a chemical process versus a flame to combust fuel, thus limiting temperature and NO_X formation. Due to the subsequent low temperature of the process, thermal NO_X is virtually eliminated. This technology designed by Catalytica, Inc. has undergone testing on a 1.5 MW Kawasaki turbine in the State of California, which operates continually in a baseload capacity. NO_X emissions of three ppm or less have been demonstrated. Tests are currently underway to apply this technology to other types and sizes of turbines, but that data is currently unavailable. At this time it is unclear whether this technology, in its current state, could be applied to turbines used to generate peak power, which experiences repeated start-up, shutdowns, and changing load conditions. Therefore, for the purposes of this BACT analysis, the XONON™ system was not considered to be technically feasible.

Selective Catalytic Reduction (SCR)

SCR is a post-combustion control technology in which ammonia is added to the flue gas in the presence of a catalyst. The ammonia and NO_X react to form nitrogen and water. Since the exhaust stream for the turbines permitted herein is between 950˚F and 984˚F, a high temperature catalyst must be considered. High temperature zeolite catalysts do exist that allow the gases entering the SCR to reach temperatures of 1,050˚F and greater. High excess air concentrations and high fuel combustion temperatures create NO_X. Lowering flame temperatures and controlling oxygen-fuel mix ratios at critical points in the combustion process can reduce NO_X formation. The catalyst accelerates the chemical reaction in which the ammonia and NO_X react to form nitrogen and water. With SCR technology, the percent reduction of NO_X emissions can be increased by adding additional catalyst and ammonia. SCR is considered technically feasible for this application.

The feasibility of SCR was evaluated based upon economic, energy, and environmental impacts. The ammonia that does not react with NO_X passes through the system and is released into the atmosphere. In addition, SCR would cause a loss of energy due to an increase in back pressure on the combustion turbines as a result of the pressure drop across the catalyst bed. Also, the start-up and shutdown requirements of the additional SCR equipment would severely impair the “quick start” capability of the peaking turbine generators thereby eliminating the “spinning reserve” capacity of the peaking units. The use of SCR was estimated to cost $13,776 per ton of NO_X removed. This cost estimate was based upon each turbine operating 2,000 hours per year. Thus, SCR was eliminated as BACT due its cost for the limited number of operational hours being permitted (2,000 hours per turbine per year).

Selective Non-catalytic Reduction (SNCR)

SNCR is a post-combustion NO_X control technology in which a reagent (ammonia or urea) is injected into the exhaust gases in a temperature range between 1,700˚F and 2,000˚F. The reagent reacts chemically with NO_X forming nitrogen and water. Outside the upper end of this temperature range, the reagent is converted to NO_X. Outside the lower end of this temperature range, the reagent will not react and the reagent is discharged into the atmosphere. The Siemens-Westinghouse Model 501D5A turbines have exhaust temperatures up to approximately 984˚F. Thus, in order to reach the

temperature range in which SNCR is effective, the exhaust temperature of the turbines would need to be raised. To raise the exhaust temperature, additional fuel would need to be combusted and thereby increasing the NO_X and other criteria pollutant emissions. SNCR has not been applied to any combustion turbines according the RBLC database. Based upon this information, SNCR was eliminated as BACT for this project.

Dry Low-NO_X Combustors

Typically high fuel combustion temperature and high excess air concentrations create NO_X. Lowering the flame temperature and controlling the oxygen-fuel mix ratios at critical points in the combustion process can reduce NO_X formation. Because of their low cost-effectiveness per ton of NO_X reduced, dry low-NO_X technology has been rapidly incorporated into new equipment designs. Dry low-NO_X burners can achieve NO_X emissions at or below 15 ppm. For this project, dry low-NO_X technology is integrated into the design of the Siemens-Westinghouse Model 501D5A turbines and represents the baseline emission of 15 ppm for this turbine.

Water or Steam Injection

This is a combustion control technology that utilizes water or steam for flame quenching to reduce peak flame temperatures and thereby reduce NO_X formation. The injection of water or steam into a gas turbine can increase the power output by increasing the mass throughput, but at the same time reduces the efficiency of the turbine. Typically, water injection can achieve NO_X emission levels of 22 ppm while firing natural gas. Since dry low-NO_X burners are all ready being installed on the turbines and dry low-NO_X burners cannot be used with water or steam injection for additional NO_X control, water injection has been eliminated as BACT for this project.

Selection of NO_X Control Technology

For this project, consisting of three stationary gas turbines operating in simple cycle mode for generation of electrical power during peak electricity demand periods and considering the 2,000 hours per year operational limitation, dry low NOx combustors with a NO_X emission limit of 15 ppmvd when corrected to 15% oxygen on a dry basis is considered BACT. This limitation is based on a three hour rolling average, and is not applicable during periods of startup and shut down.

CO Control Technology

The conditioned potential emissions of CO resulting from the project permitted herein are significant (i.e., greater than 100.0 tons per year). Therefore, a BACT analysis is required for this pollutant. Table 3 lists the control technology Aquila evaluated for the BACT analysis for CO (in order of control achieved) and the emission rates each control technology can attain.

Table 3: CO Control Technology

Control Technology	Controlled NO_x Emission Level
SCONOX™	2 ppm
Oxidation Catalyst	2 ppm
Combustion Control	25 ppm

SCONOX™

The SCONOX™ system was described in the BACT analysis for NO_X. In addition to controlling NO_X, the SCONOX™ system also controls VOC and CO. In analyzing the feasibility of the SCONOX™ system for this project, the review took into account the fact SCONOX™ controls all three pollutants. The reasons as to why SCONOX™ was eliminated as BACT for NO_X also result in the elimination of SCONOX™ as BACT for CO.

Oxidation Catalysts

Oxidation catalysts are a post-combustion technology used to oxidize CO to Carbon Dioxide (CO_2) without the introduction of additional chemicals. The activation energy for this reaction is lowered through the use of a catalyst and the oxidation then proceeds by utilizing excess air present in the turbine exhaust. An oxidation catalyst is usually platinum based, and operates in an optimal temperature range between 700˚F and 1,100˚F. Catalyst sintering can occur at higher temperatures resulting in permanent damage to the catalyst. Also, the addition of a catalyst bed onto the turbine exhaust will create a pressure drop, resulting in back pressure on the turbine. This reduces the turbine's efficiency and translates into energy costs. Conversion efficiencies for CO up to 95% are possible, and catalysts are available that will effectively handle the temperature range at which these turbines will operate.

Oxidation catalyst has not typically been required as BACT for natural gas combustion turbines operated in simple cycle mode and used exclusively for peaking service. The Missouri Department of Natural Resources acknowledges that oxidation catalyst has not been widely required as BACT in previous determinations. However, the use of oxidation catalyst is increasing and sources are voluntarily installing oxidation catalyst. The use of an Oxidation Catalyst was estimated to cost $8,618 per ton of CO removed. After evaluating the environmental, economical, and energy impacts for this permit application and considering the limited number of hours of operation to be permitted (2,000 hours per year per turbine), oxidation catalyst was eliminated as BACT for CO control.

Combustion Control

Good combustion practices include turbine design and operational elements to control the amount and distribution of excess air in the turbine combustion section and turbine exhaust gas. Good combustion practices applied to the Siemens Westinghouse Model 501D5A turbines can achieve CO emissions of 25 ppmv when corrected to 15% oxygen on a dry basis, during steady state operation.

Selection of CO Control Technology

The control technologies were evaluated considering control effectiveness, expected emission rate, expected emission reduction, energy impacts, environmental impacts, economic impacts, and the limited number of hours of operation (2,000 hours per turbine). For this project, consisting of three stationary gas turbines operating in simple cycle mode for generation of electrical power during peak electricity demand periods and considering the 2,000 hours per year per turbine operational limitation, a CO emission limit of 25 ppmvd when corrected to 15% oxygen on a dry basis using combustion control is considered BACT. This limitation is based on a three-hour rolling average, and is not applicable during periods of start-up and shutdown.

PM_{10} Control Technology

The conditioned potential emissions of PM_{10} resulting from the project permitted herein are significant (i.e. greater than 15.0 tons per year). Therefore, a BACT analysis is required for this pollutant.

PM_{10} emissions resulting from the combustion of natural gas are due to oxidation of ash and sulfur contained in the fuel. Due to its low ash and sulfur content, natural gas combustion generates inherently low PM_{10} emissions. Available technologies used for controlling PM_{10} are centrifugal (cyclone) collectors, electrostatic precipitators, wet scrubbers, and fabric filters (baghouse).

While all of these post-process technologies would be technically feasible for controlling PM_{10} emissions from combustion turbines, none of the previously described control equipment has been applied to combustion turbines exclusively burning natural gas since exhaust gas PM concentrations are inherently low. Combustion turbines operate with a significant amount of excess air that generates large exhaust gas flow rates. Aquila's combustion turbines will generate low PM emissions in comparison to other fuels due to the low ash and sulfur content of natural gas. Exhaust stream PM_{10} concentrations of such low magnitude are not amenable to control using available technologies since removal efficiencies would be unreasonably low and cost excessive. Because post-process stack controls for PM/PM_{10} are not economical for combustion turbines used exclusively in simple cycle peaking service, it was determined that BACT for PM_{10} is the use of good combustion practices.

AMBIENT AIR QUALITY IMPACT ANALYSIS

Aquila submitted a refined modeling analysis that estimates the ambient impact of NO_X, CO, PM_{10}, and formaldehyde. This analysis was performed with the Industrial Source Complex Short Term (ISCST3) dispersion model. This is an EPA approved model that is appropriate for the refined modeling required for major source review.

Emissions are generated from three combustion turbines, the natural gas heater, and the emergency diesel fire pump. The emission rate from the turbine stack will depend on the mode of operation. The turbines were modeled for operation at the ambient temperature, which corresponds to the maximum emission rate at 75%, 85%, and 100% loads. The maximum emission rate for each load occurs at an ambient temperature of 0.0˚F. The following tables contain the release parameters and the emissions rates for emission points from Aquila that were considered in the modeling.

Table 4: Aquila Modeled Stack Parameters

Unit	Source ID	Operating Loads	Stack Height (ft)	Stack Diameter (ft)	Stack Temperature (K)*	Stack Exit Velocity (ft/s)*
Turbine Number 1	EP-01	100% 85% 75%	55	24	786 (766) 745 (725) 727 (708)	58.1 (56.6) 51.8 (50.5) 47.7 (46.5)
Turbine Number 2	EP-02	100% 85%	55	24	786 745	58.1 51.8

		75%			727	47.7
Turbine Number 3	EP-03	100% 85% 75%	55	24	786 745 727	58.1 51.8 47.7
Gas Heater	EP-04	100%	43	2.5	616	31.7
Fire Pump	EP-05	100%	17	0.5	804	0.33**

*Temperature and exit velocity of Turbine 1 are less when wastewater is injected.
**Rain cap on end of stack.

Table 5: Aquila Modeled Emission Rates

Unit	Operating Loads	CO	NOx (Note 1)	PM_{10}	Formaldehyde
		(lb/hr)	(lb/hr)	(lb/hr)	(lb/hr)
Turbine Number 1	100% 85% 75%	82.70 71.00 63.00	18.61 15.96 14.16	All Loads 10.00 (15.25)	1.03 0.88 0.79
Turbine Number 2	100% 85% 75%	82.70 71.00 63.00	18.61 15.96 14.16	All Loads 10.00	1.03 0.88 0.79
Turbine Number 3	100% 85% 75%	82.70 71.00 63.00	18.61 15.96 14.16	All Loads 10.00	1.03 0.88 0.79
Gas Heater	100%	0.80	0.31	0.07	7.21×10^{-4}
Fire Pump	100%	0.17	2.06	0.04	3.67×10^{-5}

Note1: Emission rate based on 2,000 hours of operation per year.
Note 2: Emission rate in parenthesis indicates use of wastewater injection.

In each case considered in the modeling, the significance levels were not exceeded for NO_X, CO, or PM_{10}. The modeling also demonstrated that the 24-hour and annual Risk Assessment Level (RAL) for formaldehyde would not be exceeded. For the criteria pollutants (NO_X, CO, PM_{10}), the significance level is the trigger point for an increment consumption analysis and an overall ambient impact analysis. The demonstration that the significance levels are not exceeded is the only modeling requirement for this review. The insignificant modeled impacts also eliminate the need for pre-construction monitoring for NO_X, CO, or PM_{10}.

The following table lists the maximum modeled impact as well as the significance level or RAL for NO_X, CO, PM_{10} and formaldehyde in units of micrograms per cubic meter ($\mu g/m^3$). For a detailed description of the modeling analysis, along with a discussion of additional impact analyses conducted, please see the attached memorandum, *Revised Aquila – Cass County Air Dispersion Modeling*, dated October 19, 2004.

Table 6: Maximum Modeled Concentrations

Pollutant	Maximum Modeled Impact ($\mu g/m^3$)	Significance Level/RAL ($\mu g/m^3$)	Time Period
NO_X	0.39	1.0	Annual
CO	76.34	2,000	1-hour
	24.83	500	8-hour
PM_{10}	2.59	5.0	24-hour
	0.05	1.0	Annual
Formaldehyde (CAS Number: 50-00-0)	0.024	0.8	24-hour

	0.0005	0.08	Annual

STAFF RECOMMENDATION

On the basis of this review conducted in accordance with Section (8), Missouri State Rule 10 CSR 10-6.060, *Construction Permits Required*, I recommend this permit be granted with special conditions.

Jon K. Molloy
Environmental Engineer

Date

PERMIT DOCUMENTS

The following documents are incorporated by reference into this permit:

- The Application for Authority to Construct form, dated March 26, 2004, received March 29, 2004, designating Aquila, Incorporated as the owner and operator of the installation.
- U.S. EPA document AP-42, *Compilation of Air Pollutant Emission Factors*, Fifth Edition.
- Kansas City Regional Office Site Survey, dated March 1, 2004.
- Stack tests submitted along with the application, dated March 26, 2004.
- Notification of facility name change, dated April 13, 2004.
- Revised permit application for new site, received September 13, 2004.

ATTACHMENT A: Operational Schedule of the Three Siemens-Westinghouse Model 501D5A Turbines

South Harper Peaking Facility
Cass County, S29/32, T45N, R32W
Installation ID Number: 037-0063
Project Number: 2004-03-143
Permit Number: _____

This sheet covers the period from _____ to _____.
(month/year) (month/year)

Copy this sheet as needed.

Hours that Aquila is Producing Electricity = Electricity Hours		
A. Total Electricity Hours for this Month	(Note 1)	
B. 12-Month Total Electricity Hours From Previous Month's Worksheet	(Note 2)	
C. Monthly Total Electricity Hours From Previous Year's Worksheet	(Note 3)	
D. Current 12-Month Total Electricity Hours	(Note 4)	

Note 1: Total number of hours that this installation had any of the three or combination of the three turbines (Emission Points EP-01, EP-02, EP-03) connected to the utility grid by closure of the generator breaker.
Note 2: Running 12-month total of electricity hours from previous month's worksheet.
Note 3: Electricity hours reported for this month in the last calendar year.
Note 4: Amount reported in Note 2 minus amount reported in Note 3 plus amount reported in Note 1 (D = B – C + A). Less than 5,000 hours indicates compliance.

ATTACHMENT B: Individual Turbine Operational Schedule

South Harper Peaking Facility
Cass County, S29/32, T45N, R32W
Installation ID Number: 037-0063
Project Number: 2004-03-143
Permit Number: _____

This sheet covers the period from _____ to _____.
(month/year) (month/year)

This sheet is for Turbine Emission Point EP-_____

Copy this sheet as needed.

Hours that a Turbine is Burning Natural Gas = Unit Gas Hours		
A. Total Unit Gas Hours for this Month	(Note 1)	
B. 12-Month Total Unit Gas Hours From Previous Month's Worksheet	(Note 2)	
C. Monthly Total Unit Gas Hours From Previous Year's Worksheet	(Note 3)	
D. Current 12-Month Total Unit Gas Hours	(Note 4)	

Note 1: Total number of hours that this turbine was burning natural gas for this month (unit gas hours).
Note 2: Running 12-month total of unit gas hours from previous month's worksheet.
Note 3: Unit gas hours reported for this month in the last calendar year.
Note 4: Amount reported in Note 2 minus amount reported in Note 3 plus amount reported in Note 1. (D = B – C + A)
Less than 2,000 hours indicates compliance.

ATTACHMENT C: Gas Heater Operational Schedule

South Harper Peaking Facility
Cass County, S29/32, T45N, R32W
Installation ID Number: 037-0063
Project Number: 2004-03-143
Permit Number: _____

This sheet covers the period from _____ to _____.
(month/year) (month/year)

This sheet is for Turbine Emission Point EP-_____

Copy this sheet as needed.

A. Total Hours of Operation for this Month	(Note 1)	
B. 12-Month Total Hours of Operation From Previous Month's Worksheet	(Note 2)	
C. Monthly Total Hours of Operation From Previous Year's Worksheet	(Note 3)	
D. Current 12-Month Total Hours of Operation	(Note 4)	

Note 1: Total number of hours that the gas heater was operating for this month.
Note 2: Running 12-month total of operational hours from previous month's worksheet.
Note 3: Hours of operation reported for this month in the last calendar year.
Note 4: Amount reported in Note 2 minus amount reported in Note 3 plus amount reported in Note 1. (D = B – C + A)
Less than 6,000 hours indicates compliance.